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Factors Influencing the Performance of Fresh Graduates in the Electrical Engineer Board Examination: The Roles of Academic Intervention, Review Center Attendance, Self-Review Practices, Personal Readiness and Morale Stability

Aaron John P. Balingit[1], Issabela G. Cancio[1*], Edramiel S. Del Rosario[2], Miguel S. Guzman[3], Jairus Duncan L. Tiglao[4], Dr. Reynaldo H. Gomez Jr.[5] & Engr. Alma L. Tangcuangco[6]

[1,2,3,4]BSEE-4C, Department of Electrical Engineering, College of Engineering and Architecture, Pampanga State University, Cabambangan, Bacolor, Pampanga, Philippines. [5]Chairman, Department of Electrical Engineering, College of Engineering and Architecture, Pampanga State University, Cabambangan, Bacolor, Pampanga, Philippines. [6]Faculty, Department of Electrical Engineering, College of Engineering and Architecture, Pampanga State University, Cabambangan, Bacolor, Pampanga, Philippines. Email: 2021304169@pampangastateu.edu.ph[*]

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ABSTRACT

The Registered Electrical Engineer Licensure Examination (REELE) is a key indicator of the quality and effectiveness of engineering education. The goal of this study is to determine how quality of study factors affects performance on the REELE among electrical engineering graduates of a state university. Specifically, it investigated the relationship between comprehensive examination results and licensure results, compared cohorts and review-center effects, and discussed academic and non-academic drivers of exam performance. The study utilized a mixed-methods design. Quantitative data was collected via a structured questionnaire sent out to first-time examinees in the 2019–2024 cohorts. Data used descriptive and inferential statistics (weighted mean, standard deviation, Analysis of Variance or ANOVA, Pearson Chi-Square Test), and qualitative data were thematically analyzed. Results showed that institutional academic resources, review activities, and review center facilities were robust predictors of exam readiness. Review material, strong instructors, emotional support, and spirituality were overwhelmingly found to be more influential in the likelihood to be ready than were the other three factors. The Pearson Chi-Square Test was significant for comprehensive examination performance and the licensure outcomes. There were no marked differences among groups by review center. Qualitative themes identified mastery of essential concepts, practice over time, time-management, self-regulation, persistence, peer support, and faith as critical for licensure success. In general, both academic preparedness, institutional support, psychological preparedness, and individual effort seem to have driven licensure performance. These findings can help improve instructional approaches and review programming.

Keywords: Electrical Engineering; Licensure Examination; Self-Review; Comprehensive Examination; Review Centers; Morale Stability; Academic Intervention; Non-Academic Factors; Student Readiness; Mixed Method.

1.0. Introduction

The licensure examination was a significant measure of the performance of engineering education in the Philippines. The modernization process in general, focusing on Electrical Engineering, became an important one among engineering courses, with continuous learning being the name of the game to keep pace with technology advances [1,2]. The passing exam results in the Philippines were the single most important metric of an institution's performance. Institutions are expected to exceed the national passing rate [3].

Republic Act 7920 mandates that it is mandatory to pass the Registered Electrical Engineer (REE) licensure examination in order to practice as an electrical professional. Novel strategies like holistic examinations and review sessions were carried out in the Electrical Engineering Department of a state university in Region III. Self-regulated learning was found to be an effective way to promote student preparedness [4], and critical thinking skills were regarded as necessary in order to excel in engineering courses [5]. The examination preparation period was complicated by several challenges that affected students' mental stress, examination atmosphere, and examination system condition. Academic stress, bad study conditions and technical problems adversely affected student performance on examination [6]. Challenges may also have been: difficulty understanding examination questions, less review time, clashes between schedules, lack of financial support [7].

Previous research shows that the Electrical Engineering Department of a state university in Region III achieved an average passing rate of 33.81% during 2017 to 2022, which differs significantly from the national passing rate of 52.74% during that same period [19] as revealed by this study. There were some concerns regarding the efficiency of the institution's interventions which have been implemented to improve the graduates' ability to pass board examinations due to the difference between the institutional and national passing rate gap.

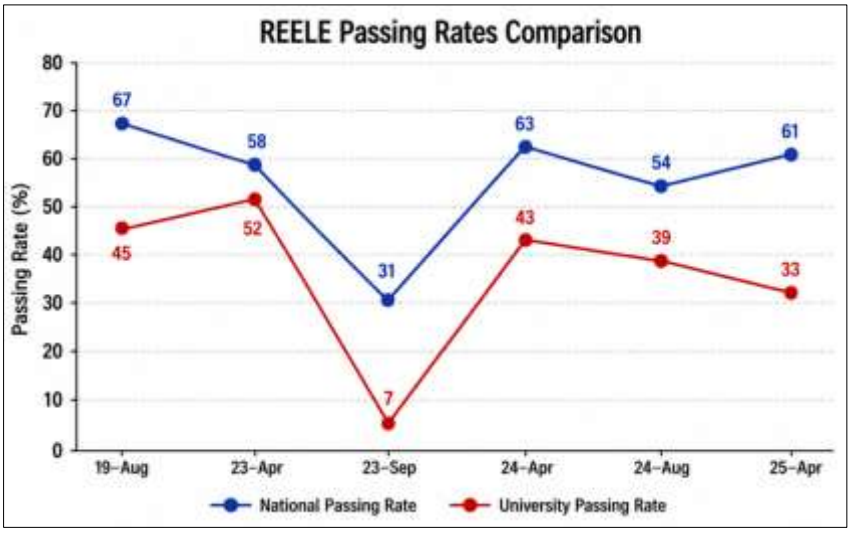

Figure 1. REELE Passing Percentage Comparison between a University and National Passing Rate (2019 and 2023-2025)

Figure 1 shows the comparison statistics of the Registered Electrical Engineer Licensure Examination (REELE) passing percentages of a State University and the national passing rate from 2019 and 2023–2025 is shown in Figure 1. It provides background for comparing the institution's passing performance in relation to the nation's average, which was to be the building block on the influence such components should have on graduates' attainment of licensure examination scores. The latter comparison suggests the significance of examining whether the advantages of academic interventions, review preparation, financial assistance, and self-preparedness were the effective predictors for a successful licensure examination attempt among the graduates. The aim of this study is to find out the determinants that affect the achievement of a state university student in Region III, Philippines on the Electrical Engineer Licensure Examination. By using a mixed methods approach, quantitative for the numerical measurements and qualitative for the narrative case, the research investigated the relationships among the factors that contribute to students' examination preparedness: morale stability, financing, involvement in review sessions, examinations in the holistic sense of the term, and enrollment in the review centers.

1.1. Research Objectives

The study aims to determine the factors influencing the performance of fresh graduates in the Registered Electrical Engineer Licensure Examination (REELE). Specifically, it aims to:

1) Determine student readiness and confidence level for the Electrical Engineer Licensure Examination.

2) Evaluate school-based review sessions and comprehensive examinations among Electrical Engineering board examinees.

3) Assess the extent to which the present non-academic conditions (e.g., mental health, financial support, time management, peer support) influence the performance of this board examination.

4) Investigate the relationship of school comprehensive examination scores and review centers' pre-board examination scores to the actual board examination scores.

5) Compare the board examination performance of Electrical Engineering examinees across different review centers.

2.0. Literature Review

Ampuan [8] identified common issues including challenges such as distraction and inadequate study environments, and coping strategies to overcome these issues: the early study days were characterized as well as frequent study and studying in an adequate environment. Other research has explored the effect of review programs on licensure examination performance. Ferrer [9] discovered that passing rates were linked to curriculum design and review programs and Juanatas [10] reported review courses as a strong predictor of success. Fiscal and Roman [11] also found an association between pre-licensure examination scores and actual performance. Review programs and full examinations enhanced preparedness, as academic interventions, were associated with improved readiness [12, 13, 14]. However, financial stability and mental preparedness (non-academic factors) were also relevant [15]. Bote et al. [16] stressed that personal effort is one of the key factors that plays an important role in success, as confirmed by Amparado and Diamante [17]. In spite of such data, previous studies also indicate no statistically different outcome of academic and non-academic factors on board examination performance. Moreover, while different interventions were attempted, there has been little to no evident evidence that such interventions have a consistently positive impact on licensure success [18].

3.0. Methodology

3.1. Research Design

To elaborate on the impact of changes in performance on graduates in the Electrical Engineer Board Examination, this study was carried out using mixed methods, quantitative and qualitative methods. The quantitative part mainly used a causal-comparative research method, investigating the relationship among several variables, such as comprehensive examination performance, attendance at review centers, self-review practices, moral support, and financial support received by graduates. Particular attention was also given, comparing the comprehensive examination results in 2019 with the licensure examination, evaluating the variation of the performance in the board examination among its various review centers and the performance of the 2019 and 2022 - 2024 batch graduates in the licensure examination. The causal-comparative design enables the researchers to investigate the potential determinants of the performance in the board examination without changing the variables related to the analysis. Quantitative data was extracted from Pampanga State University (PSU) graduates that had taken the Registered Electrical Engineer Licensure Examination (REELE) for the first time by means of a structured questionnaire formulated around the objectives of the study. Descriptive and inferential statistics were applied when analyzing the numerical data collected. Likert scale, with its proven effectiveness, is one of the most widely

used instruments for evaluation across various scientific and professional fields [20]. With that, respondents' perceptions on the factors identified in the study that affected the graduates' performance in the board examinations were given in the format of five points Likert scale; perceived effectiveness of the factors that affect performance was based on the five points Likert scale. Statistical tests including mean, standard deviation (SD), independent sample t-test, paired sample t-test (PST), and one way ANOVA (One Way Analysis of Variance) was applied to evaluate the statistical significance of the relationships and the differences among the variables. Such as, the paired sample t-test has been utilized to compare the achievement of the students in the course content regarding the 2019 comprehensive test as well as the licensure examination results and ANOVA was used in analyzing the performance difference among the students from review institutions and the board subjects. The results of licensure examinations of batches 2019 and 2022 - 2024 were also examined to identify trends and differences in passing performance. Qualitative methods were also used as research methods in the analysis, whereby participants' opinions were made available, and the quantitative findings were supplemented with feedback to make the claims more relevant to the study. Qualitative research was carried out of the experiences, comments and insights of interviewees about the experience, and to learn from the preparatory tasks and experiences on the licensure examinations. Among the feedback received was identifying patterns in thematic analysis of recurring findings, and key factors influencing the takers' performance in the board examinations. This allows for a comprehensive overview of the study, ultimately providing the researchers with meaningful conclusions and recommendations as the results were summarized following a merging of the quantitative and the qualitative analysis.

3.1.1. Survey Questionnaire

The goal of the survey questionnaire of the "Factors Influencing the Performance of Fresh Graduates in the Electrical Engineer Board Examination: The Roles of Academic Intervention, Review Center Attendance, Self-Review Practices, Personal Readiness and Moral Stability" was to ascertain what influence is on the performance of the Electrical Engineering graduates during the Registered Electrical Engineer Licensure Examination. This study was conducted on the graduates of Pampanga State University who sat for the board examination from August 2019 and April 2023 to April 2025. It collected information about academic intervention, personal readiness, and morale stability during the review period. The first section presented respondents' demographic characteristics, including age, sex, year of graduation, attendance in review sessions, participation in comprehensive examinations, enrollment in review centers, and the type of review program undertaken (face-to-face, online, modular, or mock examinations). This section details the educational and review experiences of respondents. The second section emphasized the components concerning preparation of board examination such as academic interventions, review centers, and self-review. It reviewed university review sessions, comprehensive examinations, review materials, instructors, mock examinations, study habits, time management, discipline, and confidence in independent preparation. The questionnaire also featured sections on Personal Readiness and Morale Stability. Personal Readiness indicates consistency in studying, participation in review activities, and preparedness for the board examination, while Morale Stability assesses the emotional, spiritual, social, and financial factors of family support, prayers, stress, confidence, and financial resources. An open-ended question is also included for recommendations and suggestions on improving students' performance in the Registered Electrical Engineer

Licensure Examination. The main quantitative instrument for data collection used in this study was the structured questionnaire that was developed based on the research objectives. The items of the questionnaire included review preparation, self-review practices, comprehensive examination performance, participation in the review center, and the moral and financial support received by the graduates. Respondents' perceptions of the established factors influencing performance in board examination were assessed by a five-point Likert scale. Use the following scale and verbal interpretations:

Table 1. Five-point Likert Scale Used to Evaluate the Respondents' Perceptions Regarding the Factors Affecting Performance in the REELE

Scale	Range	Verbal Interpretation
5	4.21 – 5.00	Strongly Agree
4	3.41 – 4.20	Agree
3	2.61 – 3.40	Moderately Agree
2	1.81 – 2.60	Disagree
1	1.00 – 1.80	Strongly Disagree

To analyse the performance trends of graduates in the Registered Electrical Engineer Licensure Examination from 2019 and 2022–2024, the researchers computed the overall mean ratings of the respondents for each examination year with Table 1 as reference. Data calculations included average percentage ratings of graduates who took the licensure examination during the specified periods. Mean ratings derived from the computation were calculated and were applied to analyse performance from different years of examination. The obtained ratings were interpreted by the researchers via the established performance descriptions to determine which batch produced the highest and lowest performance in the licensure examination. The analysis allowed researchers to investigate the variances and trends of performance in the board examination of graduates of varying years and to establish possible differences in examination outcomes over time. The overall mean ratings of graduates in the Registered Electrical Engineer Licensure Examination were assessed using the following scale:

Table 2. Performance Rating Scale Used to Classify Overall Mean Percentage and Verbal Interpretation for Evaluating Performance in the REELE

Percentage Rating Range	Verbal Interpretation
75.00% and above	Excellent Performance
70.00% – 74.99%	Highest Performance
65.00% – 69.99%	Moderate Performance
60.00% – 64.99%	Lower Performance
Below 60.00%	Lowest Performance

Table 2 was used to categorize and interpret computed overall mean ratings per examination year, providing verbal descriptions of each batch's licensure performance**.**

3.2. Sampling Size and Technique

A quantitative perspective was taken in the study, in which a proportionate stratified random sampling was used for respondents from varying batches of graduates. Random sampling technique was used to give all qualified respondents equal opportunity for selection to minimize bias in choice and to eliminate selection patterns. Stratified random sampling allowed a group of the respondents in proportion to the batch of graduates and therefore adequately represented in the sample. The sampling was based on proportionate stratified random sampling to ensure well representation in all identified subgroups; however, actual data collection on this topic was determined by the willingness and availability of the respondents to participate. Using a 95% confidence level in relation to a 5% margin of error, Cochran's formula with finite population correction was used to calculate an appropriate sample size. A total population of 397 graduates was the basis to estimate the required sample size of 196 respondents. However, 217 responses from participants were successfully retrieved in the survey, which was greater than the minimum sample required. This enlarged number of participants improved credibility, reliability, and statistical robustness of the data retrieved for analysis. This approach to this sampling added confidence to the results and the extent of its sampling helped make the survey sample more meaningful and better represent some of the concerns of the target population.

3.2.1. Performance Outcome by Examination Date

Table 3. Distribution of REELE Passing and Failing Percentage of First-Time Takers of PSU Fresh Graduates from 2019 and 2023-2025.

Date of Examination	Passed	Failed	Fresh First-Time Takers	Percentage
August 2019	29	33	62	46.77%
April 2023	57	26	83	68.67%
September 2023	3	2	5	60.00%
April 2024	56	65	121	46.28%
August 2024	4	8	12	33.33%
April 2025	44	70	114	38.60%

This table 3 shows the passing performance of first-time takers who were also fresh graduates of the Bachelor of Science in Electrical Engineering (BSEE) at Pampanga State University in the Registered Electrical Engineer Licensure Examination from 2019 and 2023–2025. The table used descriptive quantitative techniques (frequencies and percentages) to analyse passers, failures, total takers, and corresponding passing percentages for the examination periods. These results reflected fluctuating passing rates in each examination period, suggesting inconsistency in licensure examination performance of PSU graduates. The volatility of the passing percentages indicated that preparedness and competency of graduates were not uniform across batches and examination periods. Variations might be in academic foundation, mastery of concepts, study habits, examination difficulty, and external support systems such as review centers. Although certain examination periods reflected satisfactory outcomes, the inconsistent trend suggests that success in the licensure examination was not sustained over time. The findings further indicate that passing performance is influenced by multiple academic and non-academic factors that affect graduates' readiness for the licensure examination.

3.2.2. Participants' Characteristics

Table 4. Respondents' Demographic Profile (Sex, Age, and Year Graduated) and Passing Percentage.

Demographic Profile		Frequency	Passed REELE	Failed REELE	Passing Percentage
Sex					
Male		190	115	75	60.53%
Female		27	20	7	74.07%
	Total	217	135	82	
Age					
23-24 y/o		70	40	30	57.14%
25-26 y/o		115	73	42	63.48%
27 y/o and above		32	23	9	71.88 %
	Total	217	136	81	
Year Graduated					
2019		31	24	7	77.42%
2022		47	36	11	76.60%
2023		72	48	24	60.00%
2024		67	31	36	46.27%
	Total	217	139	78	

Table 4 presents the data of the respondents' sexual identity, age, year graduated including the total passed and failed in REELE. The data reveals that the majority of the respondents are male and majority of the respondents are of the age of 25 to 26 years old. Although females are fewer than males, females have a higher passing percentage. The same can be said with respondents who are 27 years old and above, fewer quantity but gained the highest passing percentage compared to other ages. The number of respondents per year is met via proportionate stratified sampling, having a total of 217 respondents.

Table 5. Distribution Of Respondents According to the Review Centers Attended Across Different Graduation Batches.

Review Centers (2019)	Reviewees
RC1	1
RC3	17
RC4	10
RC5	2
Total	30
Review Centers (2022)	Reviewees
RC1	12
RC3	20
RC4	15

Total	47
Review Centers (2023)	Reviewees
RC1	9
RC2	1
RC3	20
RC4	29
RC5	11
Total	70
Review Centers (2024)	Reviewees
RC1	26
RC2	3
RC3	3
RC4	17
RC5	12
Total	61

In addition, the study considered the respondents' review centers as part of the analysis to determine whether differences in review center enrollment influenced licensure examination performance. The review centers were categorized and labeled as RC1, RC2, RC3, RC4, and RC5 as shown in Table 5 based on where the respondents enrolled during the preparation for the Registered Electrical Engineer Licensure Examination (REELE). Many Electrical Engineering graduates enroll in review centers to strengthen mastery of engineering concepts, enhance problem-solving abilities, and familiarize with board examination formats, techniques, and strategies. By including review center participation in the analysis, the study aimed to identify whether significant differences existed in the performance outcomes of graduates from different review institutions.

3.3. Ethical Considerations

The well-being, privacy, volition, and comfort of the participants were upheld during the data gathering process. Prior to the commencement of any interview, it is essential to obtain the necessary permissions. An informed consent was attached which indicates the respondents' anonymity and that answers are going to be purely used for research purposes only. The respondents' participation was voluntary and non-coercive. Participants have the right to decline, to ask for time-outs, and to skip questions the respondents cannot answer. Confidentiality and anonymity of the participants was maintained over the course of the entire study including the identification card submitted in the form. The Department of Electrical Engineering under the College of Engineering and Architecture (CEA), guided by the university's vision, mission, quality policy, and mandates, continues to strive hard to live by the university's expectations.

3.4. Statistical Treatment of Data

Descriptive and inferential statistical tools were employed to examine the collected data. Frequency and ranking were applied to describe the demographic profile and distribution of respondents. Mean and standard deviation were utilized to determine the respondents' level of agreement regarding the factors affecting board examination

performance and to measure the variability or spread of data points (standard deviation) around the average (mean). To determine whether there were significant differences between variables, inferential statistical methods were employed. The independent sample t-test was used in order to compare answers across groups categorized according to the result of the licensure examination. The paired sample t-test was applied to examine how comprehensive examination performance was associated with licensure examination performance. As for ANOVA, a one-way analysis of variance was used to assess whether statistically significant differences existed between respondents of diverse review centers and participants across different board subjects. Qualitative responses collected from respondents were studied through thematic analysis. For this, the authors thoroughly analyzed and coded the responses to find common themes, experiences, and perceptions regarding examination preparation and performance. Responses to these questions were grouped under similar categories and subsequent themes were interpreted to reinforce and conclude the findings of the quantitative part of the study. Qualitative information combined with the statistical results yielded a better understanding of the experiences and barriers of the graduates to the licensure examination preparation process. Pearson Chi-Square Test of Independence was also utilized to examine whether some demographic variables were independent of the passage or failure of the licensure examination in relation to the demographic variables employed. One was asked to see if board examination performance was significantly correlated to sex, age, and year graduated in the test.

The following hypotheses were tested in the study:

Null Hypothesis (H_0)

- There is no significant relationship between the identified factors and the performance of graduates in the Registered Electrical Engineer Licensure Examination.
- There is no significant association between the demographic profile of the respondents and the board examination outcomes categorized as pass or fail.

Alternate Hypothesis (H_1)

- There is a significant relationship between the identified factors and the performance of graduates in the Registered Electrical Engineer Licensure Examination.
- There is a significant association between the demographic profile of the respondents and the board examination outcomes categorized as pass or fail.

The level of significance for all statistical tests was set at 0.05. If the computed p-value was less than 0.05, the null hypothesis will be rejected, indicating a significant relationship or association among the variables. Conversely, if the p-value was greater than 0.05, the null hypothesis will then be accepted, indicating no significant relationship or association.

3.5. Calculation of the Gathered Data

This research used a statistical test, t-test to be specific. The researchers utilized paired sample t-tests. Paired sample t-test was used to compare the means of two groups: comprehensive examination score and board examination score. It is frequently used in hypothesis testing to determine whether a process or treatment actually

has an effect on the population of interest, or whether two groups are different from one another. A stratified-systematic sampling technique was applied in this study to determine the total number of data points in the sample.

The t-test value was computed using the formula in equation 1.

$$t = \frac{\frac{d}{sd}}{\sqrt{n}} \quad (1)$$

wherein; t = t-value, d = mean difference, sd = standard deviation of differences, and n = number of pairs.

Cohen's d was also sought to know the difference between two group means, in which equation 2 formulates.

$$d = \frac{\bar{x}_1 - \bar{x}_2}{s} \quad (2)$$

wherein; d = Cohen's d, $\bar{x}_1$ = group 1 mean, $\bar{x}_2$ = group 2 mean, and *s* = pooled standard deviation

In calculating the standard deviation and mean of each indicator, the formulas seen in equation 2 and equation 3 were used.

$$SD = \sqrt{\frac{\sum (x-M)^2}{n-1}} \quad (3)$$

wherein; SD = Standard Deviation, x = value, M = mean, and n = total number.

$$M = \frac{\sum x_i}{n} \quad (4)$$

wherein; M = mean, ∑xi = sum of data, and n = amount of data.

The researchers also utilized Analysis of Variance (ANOVA). To calculate the ratio of variation between groups to the variation within a group, equation 4 was used.

$$F = \frac{MS_{between}}{MS_{within}} \quad (5)$$

wherein; *F* = F-value, MSbetween = variance between groups, and MSwithin = variance within groups

The researchers also used Cochran's formula, as seen in equation 5 and equation 6, with finite population correction at a 95% confidence level and 5% margin of error.

$$n_0 = \frac{Z^2 p(1-p)}{e^2} \quad (6)$$

wherein; n0 = initial sample size, z = z-value (confidence level), p = proportion, and e = margin of error

$$n = \frac{n_0}{1+\frac{n_0-1}{N}} \quad (7)$$

wherein; *n* = sample size, *n*0 = initial sample size, and *N* = total population

The calculation of the sample size per year of the respondents was determined using the formula shown in equation 7. Upon computing the total number of data points in the sample, the researchers proceed to gather data in line with the total sample size.

$$sample\ per\ year = \frac{total\ population\ each\ year}{total\ population} x\ total\ number\ of\ respondents \quad (8)$$

For the computation of the Content Validity Index of the survey questionnaire, the summation of rate per validators was divided by the total number of validators as shown in equation 8.

$$CVI = \frac{\Sigma\ rate\ per\ validators}{Total\ number\ of\ validators} \quad (9)$$

In computing for the Pearson Chi-Square, the formula equation 9 was applied. The formula was used to determine if there was a significant association between selected demographic variables and the licensure examination outcomes categorized as pass or fail.

$$x^2 = \Sigma \frac{(O-E)^2}{E} \quad (10)$$

wherein; x^2 = Pearson Chi-Square, O = observed frequency and E = expected frequency

With a spreadsheet reference for the columns and rows of data, the expected frequency was obtained by using equation 10.

$$E = \frac{Row\ Total\ x\ Column\ Total}{Grand\ Total}$$

4.0. Results and Discussions

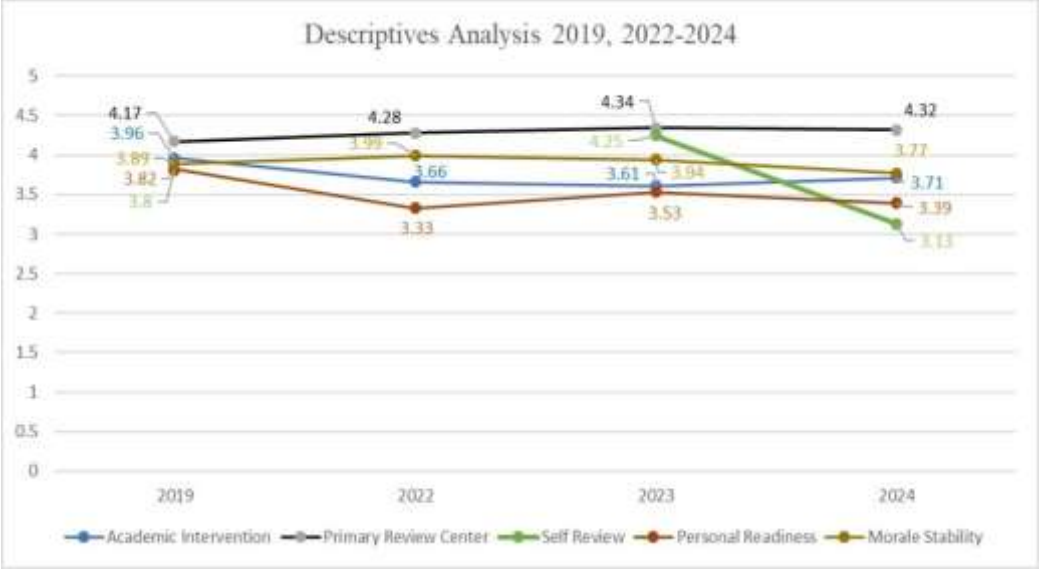

Figure 2. Factors' Grand Means of Respondents' Assessment from batches 2019 and 2022-2024**.**

The descriptive analysis showed that respondents generally maintained favorable perceptions across the five indicators from 2019 and 2022 to 2024, namely Academic Intervention, Primary Review Center, Self-Review, Personal Readiness, and Morale Stability. Among these indicators, the Primary Review Center remained the most stable and was reflected as a positively evaluated factor throughout the covered years. Review centers were perceived by respondents as effective and reliable due to the quality of instructors, review materials, handouts, mock examinations, and other resources offered. It also shows that review centers assisted respondents in comprehending complicated concepts and enhanced the students' preparation for the board examination. On the

other hand, Academic Intervention, Self-Review, and Personal Readiness experienced fluctuations and slight declines over the years, although respondents still gave generally favorable assessments. The findings indicated that the structured review exercises, competent instructors, organized study habits, and active engagement in review activities boosted the students' confidence and readiness for licensure examinations. Self-regulated learning effectively enhances students' academic, strategic learning behaviours, and self-efficacy, demonstrating the value of self-review skills to improve outcomes [21]. Morale Stability remained relatively consistent, indicating the vital importance of spirituality and emotional support in helping respondents cope with pressure generated by the board examination process. Combined supports contribute to a stable psychological condition [22], as support systems enhance outcomes and reduce stress. Although there were some challenges in maintaining discipline, study habits, and access to review materials, personal readiness and academic support continued to have a positive influence on licensure examination performance.

Table 6. The Mean and Frequency Results of Batch 2019 and Batch 2024 Comprehensive Examination and Licensure Examination of the Electrical Engineering Department Across Board Subjects.

Batch 2019				
Comprehensive Examination				
Subject	Mean Percentage Score	Frequency	Percentage	Remarks
Math	70.66%	38	77.55%	Passed
ESAS	72.36%	11	22.45%	Failed
PEEs	74.41%			
Total	100%	49	100%	
August 2019 Licensure Examination				
Subject	Mean Percentage Score	Frequency	Percentage	Remarks
Math	69.44%	32	51.61%	Passed
ESAS	69.16%	30	48.39%	Failed
PEEs	61.95%			
Total	100%	62	100%	
Batch 2024				
Comprehensive Examination				
Subject	Mean Percentage Score	Frequency	Percentage	Remarks
Math	71.18%	52	46.02%	Passed
ESAS	69.38%	61	53.98%	Failed
PEEs	69.54%			
Total	100%	113	100%	
April 2025 Licensure Examination				
Subject	Mean Percentage Score	Frequency	Percentage	Remarks
Math	59.33%	44	38.60%	Passed

ESAS	69.25%	70	61.40%	Failed
PEEs	60.36%			
Total	100%	114	100%	

Table 6 compares results of the Comprehensive Examination of the Electrical Engineering Department with the Licensure Examination. Results showed that in Mathematics, students generally maintained satisfactory performance, while Engineering Sciences and Allied Subjects (ESAS) and Professional Electrical Engineer (PEEs) subjects recorded noticeable declines in the Licensure Examination. The findings of this study indicate that a competent level of preparation was attained by the examinees in the Comprehensive Examination. However, takers had difficulties in conceptual application and problem solving on the board examination questions. These results demonstrate gaps that may exist between institutional assessments and the competencies needed for licensure examination (e.g., mastery of concepts, analytical, problem-solving). Moreover, the findings also indicate that a significant percentage of the participants failed both the 2024 Comprehensive Examination and the April 2025 Registered Electrical Engineer Licensure Examination. Generally, those who had high scores in Math, ESAS, and PEEs and achieved an average pass were also found to have completed higher level examinations indicating further academic preparation for the actual licensure examination. Despite the various factors (examinations), it was concluded that a statistically significant proportion were failing; nevertheless, to achieve pass scores in passing average. Individuals with low and inconsistent subject performances were more likely to be given failing remarks, suggesting that those takers did not meet the competency standards of the board examination. These results suggest the requirement for enhanced review sessions, better-than-usual instruction, competency focus of the study, and preparation systems as measures to enhance outcomes at the upcoming licensure examination.

Table 7. The Mean and Frequency Results of Batch 2022 and Batch 2023 Registered Electrical Engineer Licensure Examination of the Electrical Engineering Department Across Board Subjects.

Batch 2022				
April 2023 Licensure Examination				
Subject	**Mean Percentage Score**	**Frequency**	**Percentage**	**Remarks**
Math	75.37%	57	68.67%	Passed
ESAS	67.19%	26	31.33%	Failed
PEEs	71.40%			
Total	**100%**	**83**	**100%**	
August 2023 Licensure Examination				
Subject	**Mean Percentage Score**	**Frequency**	**Percentage**	**Remarks**
Math	66.60%	3	60.00%	Passed
ESAS	65.20%	2	40.00%	Failed
PEEs	59.20%			
Total	**100%**	**5**	**100%**	
Batch 2023				
April 2024 Licensure Examination				

Subject	Mean Percentage Score	Frequency	Percentage	Remarks
Math	68.49%	56	46.28%	Passed
ESAS	67.52%	65	53.72%	Failed
PEEs	63.96%			
Total	**100%**	**121**	**100%**	
August 2024 Licensure Examination				
Subject	**Mean Percentage Score**	**Frequency**	**Percentage**	**Remarks**
Math	58.08%	3	25.00%	Passed
ESAS	57.92%	9	75.00%	Failed
PEEs	58.75%			
Total	**100%**	**12**	**100%**	

The results of the Batch 2022 and Batch 2023 Registered Electrical Engineer Licensure Examinations in April and August are shown in Table 7. The analysis indicated examinees performed relatively well in Mathematics. In contrast, ESAS and PEEs were the most difficult topics. The April examination period recorded better examination performance and higher passing rates than the August examination period, which suggests that a larger proportion of takers met the required passing standard during the April examinations. Furthermore, the findings implied that both batches of examinees had difficulties in ensuring the competency standards specified in the licensure examination were met, especially in respect of ESAS and PEEs. Stronger performers across the subject areas are more likely to obtain passing remarks and poor consistency results may lead to a failure in responses. The findings also suggested that the board examination involved more conceptual, analytical and problem-solving skills than some of the examinees could discern. In summary, these findings emphasized enhanced preparation for the review at that step, mastery of technical concepts, and support during the academic phase of the examination, suggesting the potential for these factors to assist future licensure examination performance.

Table 8. Relationship Between Electrical Engineering Students' Comprehensive Examination Performance and Licensure Examination Results of Batch 2019 and Batch 2024 via Paired Sample T-Test

Paired Sample T-Test				
Batch 2019				
Variables	**T- Stat**	**p-value**	**Cohen's d**	**Remarks**
Comprehensive Examination Score	**2.3**	0.002	0.47	There is significant relationship between comprehensive examination and board examination
Board Examination Score				
Batch 2024				
Comprehensive Examination Score	**6.54**	0.001	0.61	There is significant relationship between comprehensive examination and board examination
Board Examination Score				

Table 8 portrays that the paired sample t-test results revealed that there is a statistically significant relationship between the Comprehensive Examination scores and the Board Examination scores of the 2019 respondents. The

computed t-statistic of 2.3 and p-value of 0.002 indicate that the probability of obtaining the observed difference by chance is very low and is below the 0.05 level of significance. This finding suggests that the students' performance in the comprehensive examination is significantly related to the students' actual performance in the board examination. Furthermore, the computed Cohen's d value of 0.47 indicates a moderate effect size, implying that the relationship between the two examination results has a meaningful practical impact.

In the same Table 8, the paired sample t-test results for the Batch 2024 Comprehensive Examination and Board Examination scores revealed that there is a statistically significant relationship between the two sets of examination results. The computed t-statistic of 6.54 and p-value of 0.001 indicate that the probability of obtaining the observed difference by chance is extremely low and falls below the 0.05 level of significance thus, the null hypothesis stating that "there is no significant relationship between the results of comprehensive examination and board examination scores of 2024" was rejected. This finding also implies that the respondents' performance in the comprehensive examination is significantly related from the takers' actual performance in the Registered Electrical Engineers Licensure Examination. Moreover, the computed Cohen's d value of 0.61 indicates a moderate to large effect size, suggesting that the relation between the two examination scores has substantial practical significance. These results imply the comprehensive examination serve as a good preparatory assessment for board examination readiness and is a good predictor for the actual difficulty and competency demands of the licensure examination. As also observed on Table 9, the respondents agree that the comprehensive examinations were helpful in preparation for the actual board examination.

Respondents' Feedback Analysis

Theme 1. Mastery of Fundamentals and Basic Concepts

Participants emphasized that having a strong foundation in basic concepts is essential for understanding advanced topics and solving difficult licensure examination problems. These themes are based on participants responses and here are the answers:

"...reading and understanding concepts well..." -p2

"Master the basics."-p9

"Focus on the basics."-p11

"Building a strong foundation from the very beginning... is essential."-p14

"Understand first the basic para hindi mahirapan lalo sa mga mahihirap na topics."-p15

"Make sure to master the fundamentals..."-p22

"Study the basic concept and fundamentals of each subject..."-p24

Theme 2. Consistent Practice and Problem-Solving

Many respondents highlighted that continuous practice, repetition, and solving problems daily improve retention and examination performance. These themes are based on participants responses and here are the answers:

"...practicing at least 100 problems daily..."-p2

"...isang way din yun ng pagpapractice ng natutunan mo."-p4

"Keep repeating solving same problems..."-p7

"Master the Active Recall Technique..."-p13

"Practice makes perfect."-16

"Improve your board exam performance through consistent study."-p20

"Always study fundamentals and practice multiple times."-p25

Theme 3. Time Management and Self-Discipline

Participants stressed the importance of managing time effectively, avoiding distractions, maintaining focus, and balancing study with rest. These themes are based on participants responses and here are the answers:

"Time management. Alamin mo ang oras kung saan alam mong makaka-focus ka." -p30

"Set aside distractions and personal problems..." -p42

"...minimize distractions."-p50

"Lastly don't use phone in entire review months..."-p54

"Focus on your weak areas."-p57

"Clear all distractions but don't forget to have fun."-p72

Theme 4. Importance of Review Centers and Pre-Board Programs

Several participants acknowledged the role of review centers and mock examinations in strengthening preparation for the licensure examination. These themes are based on participants responses and here are the answers:

"Choose your review center wisely before enrolling." -p81

"Continue the review center's invitation for pre-board subject." -p90

"The university's pre board reviews and examinations are generally effective." -p92

"Bring back the in-house review program..."-p101

"Enrolling in a review center is also highly beneficial..."-p167

"Maybe a year-end comprehensive exam (pre-board) ..." -p172

Theme 5. Positive Mindset, Motivation, and Perseverance

Participants encouraged maintaining discipline, confidence, determination, and perseverance despite challenges and pressure. These themes are based on participants responses and here are the answers:

"Mape-pressure ka, Oo. But rest a bit." -p4

"Stay disciplined, keep studying, and never give up."-p8

"Always remember, in Board Exam. It's you alone."-p12

"...your effort and preparation will determine whether you pass or not."-p50

"Focus and be passionate with your work."-p76

Theme 6. Peer Support and Learning Environment

Some respondents highlighted the importance of supportive peers, knowledge sharing, and maintaining a conducive study environment. These themes are based on participants responses and here are the answers:

"...borrow review materials from friends..."-p1

"And also share your knowledge din."-p4

"...it's ok to call a friend."-p12

"Choose your companions wisely..."-p14

"Choosing the right friends to study with also has a significant impact..."-p23

Theme 7. Faith and Spiritual Guidance

Other participants said prayer, trust in God and spiritual guidance were key forces of strength or motivation. Based on the responses of participants, the subjects are presented as such themes, and the responses are summarized in the following:

"You cannot do this alone, you need him."- p7

"Lastly Seek God. Matthew 6:33." -p12

"Always pray din God bless and good luck!" -p15

Theme 8. Curriculum and Program Improvement

Many stated that curriculum improvements would have been a major improvement for board examinations and practicalities. The following are selected from participants' commentaries and the responses:

"Change the curriculum based on board examination..." -p3

"...weak mastery of fundamental subjects..." -p6

"Bring back the in-house review program..." -p19

"Maybe a year-end comprehensive exam..." -p25

Responses from the participants have broadly emphasized that the Registered Electrical Engineer Licensure Examination is largely about the proper knowledge base and application to practice and self-motivation. The need-to-know fundamental material so that students could learn later on, and the ability to solve board examination problems, was highlighted by at least one respondent. Also, an average of participants mentioned continuous problem-solving, the active retrieval and repetitive practice as well as effective techniques to promote retention and analytical capabilities. Relatedly, managing time, minimizing distractions, and maintaining focus during the review period were also considered to be critical elements in preparation in the examination during which the tests took place. More specifically, another important takeaway from the responses is the need for external support

mechanisms and personal motivation when reviewing through the review process. Participants highlighted the importance of review centres, pre-board examinations and mock examinations and the participation in preparing licensure examination. With the findings, it suggests that the respondents confirm that these factors play a pivotal role in enhancing students' preparation for licensure examination. Several respondents mentioned the importance of supportive peers, good study environments, and favorable studying habits. Additionally, many respondents focused on remaining strong, perseverance and positive attitude in spite of the pressure and difficulties of reviewing. Some important sources of encouragement and strength included spiritual faith and prayer, which were also found to keep examinees motivated and focused on meeting professional goals.

Table 9. Descriptive Analysis of Respondents' Assessment of Personal Readiness, Academic Intervention, Morale Stability, Self-Review, and Primary Review Center from the Survey Results.

Item	Mean	SD	Interpretation
Personal Readiness			
I answered, used, and studied the handouts given by the review center/outside sources diligently.	4.08	1.05	Agree
I was able to follow the lessons and discussions given by the lecturer in the university's review sessions.	2.91	1.06	Moderately Agree
I attended the review sessions in the university consistently	3.45	1.18	Agree
Academic Intervention			
The instructors in the university's review sessions were expert and knowledgeable on the topics.	3.95	0.83	Agree
The comprehensive examinations helped me to be ready for the actual board examination.	3.72	0.93	Agree
I am satisfied with the overall experience with the academic interventions of the Electrical Engineering Department of the university.	3.97	0.84	Agree
Morale Stability			
Prayers or spiritual activities helped me	4.65	0.66	Strongly Agree

prepare for the board examination.			
Emotional support from my peers, friends, and family helped me focus on my reviews and on taking the board examination.	4.42	0.87	Strongly Agree
I was stress-free when I was reviewing for the board examination.	3.21	1.19	Agree
Self-Review			
I followed a clear and organized study plan while preparing for the board examination on my own.	3.25	0.32	Moderately Agree
The study materials I used for self-study were sufficient to cover the board examination topics.	2.00	0.29	Disagree
I regularly assessed my progress using practice problems or mock examinations.	3.19	0.32	Moderately Agree
Primary Review Center			
The instructors of the review center were expert and knowledgeable on the topics.	4.47	0.71	Strongly Agree
The materials and handouts from the review center were useful in my study.	4.43	0.80	Strongly Agree
The review materials were aligned with the topics that appeared in the actual board examination.	4.06	0.85	Agree

Table 9 contains the survey results, which shows that structured academic support, review programs, and outside support systems were among the most important contributors to respondents' preparation for the Registered Electrical Engineer Licensure Examination. Overall, respondents appreciated the review handouts, university review sessions, comprehensive examinations, and instructors' quality of teaching. The interpretations regarding standard deviation indicated that although there were similar positive perceptions of students in receiving academic support and instructor competence, there were also variations in attendance, understanding, and adaptability during review discussions. These results indicate that there was a positive effect of institutional academic programs on examination preparedness, despite the impact of learning style and comprehension variance among students on program effectiveness. Morale stability, emotional support, and spirituality were also found to be important

predictors of motivational processes during the review. Interpretation of the standard deviation revealed that respondents reported similar experiences of emotional and spiritual support and some still felt pressure and anxiety to prepare. On the contrary, the self-review practices gained lower ratings, where it was felt that the self-study materials alone were not adequate to cater to the requirements of the licensure examination. Meanwhile, primary review centers received similar positive evaluations with the same respondents perceiving instructors' competence, usefulness of review materials, and relevance of review content with the board examination in a similar light.

Table 10. The Comparison of Overall Mean Ratings of 2019 and 2022-2024 Registered Electrical Engineer Licensure Examination and Verbal Interpretation of Performance.

Year	Overall Mean Rating	Interpretation
2019	69.79%	Moderate Performance
2022	71.33%	Highest Performance
2023	67.99%	Lower Performance
2024	64.21%	Lowest Performance

Table 10 shows that the performance of Electrical Engineering graduates varied across the different years examined. The results indicate that the graduates from 2022 obtained the most favorable outcome, while those from 2024 recorded the weakest result among the groups. A declining trend can also be observed after 2022, suggesting possible changes in academic preparation, review practices, or external factors affecting examination outcomes. Overall, the findings imply that performance in the licensure examination was inconsistent across the selected years.

Table 11. One-way Analysis of Variance (ANOVA) Results of 2019 and 2022-2024 Registered Electrical Engineer Licensure Examination across Board Subjects and Verbal Interpretation.

Subject	F-value	p-value	Decision	Interpretation
Math	29.8	$2.54E^{-17}$	Reject Ho	Significant difference
ESAS	1.7	0.166	Fail to Reject Ho	No significant difference
PEEs	10.28	$1.59E^{-06}$	Reject Ho	Significant difference

The ANOVA results, as shown in Table 11, revealed that there was a statistically significant difference in the Board Examination scores across the years 2019, 2022, 2023, and 2024 for Math and PEEs, as indicated by the computed p-values being less than the level of significance. These findings indicate that the performance of examinees in these subject areas significantly varied across the different examination years. On the other hand, ESAS obtained a p-value greater than the significance level, indicating no statistically significant difference in scores across the years. Therefore, the null hypothesis, “there is no significant difference in the board examination performance across board subjects” was rejected for Math and PEEs but accepted for ESAS, suggesting that variations in examinees’ performance over the years were more evident in Math and PEEs than in ESAS.

Table 12. Relationship Between Batches 2019 and 2022-2024 Electrical Engineering Students' Comprehensive Examination Performance and Licensure Examination Results using the Pearson Chi-Square Test.

Variables	Licensure Examination Performance (Pass/Fail)	
Comprehensive Examination Performance (Pass/Fail)	Pearson Chi-Square	7.760
	p-value	0.005
	Decision	There is significant relationship

The results in Table 12 show a statistical relation between comprehensive and licensure examination performance among Electrical Engineering graduates. Specifically, the Pearson Chi-Square value is 7.760 with a p-value of 0.005, which is lower than the 0.05 level of significance. This implies that the null hypothesis, "there is no significant relationship between comprehensive examination and licensure examination" is rejected. This means that the performance in the comprehensive examination is significantly related to passing or failing the licensure examination. Students who performed well in the comprehensive examination were more likely to pass the licensure examination, vice versa.

Overall, the findings reveal that the comprehensive examination is a reliable predictor of licensure examination performance among fresh graduates. Mock board examinations or pre-board examinations are proved to be good predictors of the licensure examination performance in various fields [23, 24]. Schools can use the results of the comprehensive examination as an early sign to see which students might need extra help before taking the licensure examination. By improving review programs and making sure the comprehensive examination has similar qualities to the licensure examination questions, schools can help increase the chances of students passing [25]. These findings also show how important it is to build strong basic engineering skills during college.

Table 13. Analysis of Differences in the Performance of Electrical Engineering Students` Licensure Performance across Review Centers via One-way Analysis of Variance (ANOVA).

Review Centers	Reviewees	M	SD	Min	Max	F-Value	p-value	Decision
RC 1	48	68.1	12.4	41.1	89.15	0.8025	0.525	There is no significant difference in the licensure examination performance across review centers.
RC 2	4	71.18	16.14	56	85.95			
RC 3	60	71.05	9.81	39.2	88.95			
RC 4	71	68.48	11.2	40.15	88.35			
RC 5	25	68.77	9.15	43.05	80.2			

The data presented in Table 13 show a comparison of scores attained by Electrical Engineering graduates from five different review centers for the licensure examination. The respondents' mean scores were relatively close to one another, with RC2 achieving the highest mean score (M = 71.18) not far from the lowest mean score (M = 68.01), RC1. The minimum and maximum scores among the review centers also followed a similar pattern, while the standard deviation values ranging from 9.15 to 16.14 indicate comparable variability among the groups. Although slight differences were observed among the mean scores of the five review centers, the computed F-value of 0.8025

and p-value of 0.525 using ANOVA revealed no statistically significant difference in the licensure examination performance of students from different review centers since the p-value is greater than the 0.05 level of significance. This suggests that the review center attended by the examinees did not show a statistically significant effect on licensure examination performance.

Additionally, the findings were further corroborated through the comments from the respondents who emphasized the significance of answering mock board questions, regular reviewing, and knowledge of the basics as some of the useful preparation methods in preparation for the licensure exam. The respondents believed that such approaches contributed to better comprehension of the subject matter, enhanced problem-solving skills, and preparedness for the licensure examination.

The results suggest that passing the licensure examination is the outcome of the personal groundwork and skills of examinees as opposed to the review center itself. This is analogous with previous research that revealed that review programs are only one of numerous predictors of licensure examination performance [10, 11]. Fiscal and Roman [11] also stressed that review factors in isolation are not indicative of overall licensure examination performance. In addition, the instructional materials, subject coverage, and study strategies used by different review centers may yield comparable levels of student learning and achievement. Bote et al. [16] further validates this observation, showing that structured review programs alone do not necessarily contribute to higher pass rates, but that individual effort is also still an important factor. Hence, although review centers offer a framework and guidance during the review process, aspects of the examinees' self-discipline, preparation, and effort are also key elements in obtaining licensure.

5.0. Conclusion and Future Recommendations

5.1. Conclusion

The results indicated that academic and non-academic factors have a significant impact on the performance of Electrical Engineering graduates in the Registered Electrical Engineer Licensure Examination, both affecting the takers performance. Research results show that both academic and non-academic factors significantly influenced one another. In addition, quantitative results demonstrate that the study in quantitative terms revealed an increase in overall examination preparedness was also enhanced by structured academic interventions (in general, comprehensive examinations, university review exercises, and review center programs). Review instructors, review materials, and support from academic institutions, as presented in general, were found supportive of respondents' knowledge of engineering concepts and assessment readiness in the subjects of the licensure examination. Contrarily, the results also pointed out that many of the responses indicated that it was difficult for respondents to fully grasp the topics and control stress in preparation. Furthermore, self-review on its own fails to adequately handle the complexity and review coverage of the licensure testing task, which implies that a well-designed guided review program is more effective and organized. The findings also described wide variations in the performance in Mathematics and PEEs over years but largely no differences in ESAS across years. The Pearson Chi-Square analysis of this study demonstrated a significant association between comprehensive examination performance and licensure examination performance, which translates that the students who

performed well in the comprehensive examination were expected to pass the board examination. On the other hand, no statistically significant differences were noted between graduates' performance in the licensure examination across review centers, indicating that the influence of the individual preparation and efforts were more significant than the choice of review center on results. Moreover, the qualitative analysis also reflected the quantitative findings by demonstrating the significance of thoroughness in core concepts, systematic practice, discipline, and quality time management in success in the licensure examination. Participants pointed out that by knowing the basic subjects and repeatedly practicing and solving the problems, increased analytical skills and enhanced recall of lessons learned. Respondents also emphasized the need for maintaining focus, reducing distractions, and balancing study and rest under review conditions. In addition, respondents also described the improvement of examination readiness from review centers and pre-board examinations which were structured and provided exposure to board-type questions. The results illustrated the importance of emotional support, peer learning, a positive mindset, persistence, and spiritual guidance for successful graduates in helping to cope with examination pressures. Additionally, a number of participants also suggested strengthening the curriculum, ensuring thorough examinations, and improving institutional review programs to better align curriculum with the actual qualifications in the licensure examination. The findings show that success in the Registered Electrical Engineer Licensure Examination is dependent on several factors such as academic preparation, institutional supports, psychological readiness, and lastly, personal discipline, which collectively affect the examination score results of these graduates.

5.2. Recommendation

- For Students and Takers

Students who intend to take the Registered Electrical Engineer Licensure Examination are strongly advised to begin the preparation at an early stage. Students should be exposed to a wide range of practice problems, particularly past board examination questions.

- For Teachers

The researchers suggest that the teachers may intensify and strengthen the ways of teaching Mathematics, Electrical Engineering, and other related courses to prepare the students for the actual board examination. It is encouraged that lessons and activities are to be aligned and correlate with the problems and subjects covered in the board examination.

- For Institutions

The researchers recommend conducting board subject-based evaluations to better monitor the students' progress and identify areas that require improvement. The researchers also recommend that the curriculum and pre-board examinations are to be closely matched to the real board examination to ensure that all major topics are covered.

- For Future Researchers

Future researchers are encouraged to conduct further studies on the various factors that influence success in the Registered Electrical Engineer Licensure Examination. Future researchers may also explore the effectiveness of emerging review modalities, such as online and blended learning platforms, in enhancing student performance.

Declarations

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Conflicts of Interest

The authors declare that there are no known conflicting financial interests or relationships that could be perceived as influencing the content of the current research.

Consent for Publication

The participant gave permission for the assessment results to be processed and included in this study as signed in the Informed Consent Form.

Authors' Contributions

All authors made contributions to the conception, design, analysis and interpretation of the study. All authors have seen and approved the final version of the paper.

Informed Consent

Informed consent was obtained from all respondents before involving them in the study. All the respondents were told about the purpose of the study, their right to volunteer in it and that the information given by them will be confidential and will be used only for research purposes.

Data Availability and Materials

Data and materials used for this study can be obtained by contacting the corresponding author upon reasonable request.

Institutional Review Board Statement

Not Applicable.

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Declaration of Artificial Intelligence

The authors declare that artificial intelligence was not used in the writing, analysis and preparation of this manuscript.

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